Claims

We claim:

1. A method of monitoring the condition of a thermal barrier coating within a turbine engine having an operating temperature in excess of 1200 ^{0}C, said method comprising:

embedding and thermally protecting a fiber lead into the thermal barrier coating;

embedding at least one fiber Bragg grating sensor into the thermal barrier coating such that the fiber Bragg grating is affected by a thermal or mechanical expansion of the thermal barrier coating; and

using the thermal or mechanical expansion of the thermal barrier coating or the changing of a refraction index of the fiber to determine changes in temperature or strain of the thermal barrier coating.

2. A method of monitoring according claim 1, wherein the fiber lead is thermally protected by placing into a thin stainless steel or Nickel tube.

3. A method of monitoring according claim 2, wherein the fiber Bragg grating is placed into the thin stainless steel or Nickel tube.

4. A method of monitoring according claim 2, wherein the thin stainless steel or Nickel tube is filled with air or a soft heat resistant filling material.

5. A method of monitoring according claim 1, wherein the fiber lead is placed into a thin hole of the substrate.

6. A method of monitoring according claim 3, wherein the fiber Bragg grating is placed loose in the tube.

7. A method of monitoring according claim 6, wherein the fiber Bragg grating is placed by a helical winding in the tube.

8. A method of monitoring according claim 6, wherein the fiber Bragg grating is placed meander like in the hole.

9. A method of monitoring according claim 5, wherein the fiber lead is placed loose in the hole.

10. A method of monitoring according claim 9, wherein the fiber lead is placed by a helical winding in the hole.

11. A method of monitoring according claim 10, wherein the fiber lead is placed meander like in the hole.

12. A method of monitoring according claim 1, wherein the fiber lead or the fiber Brag gratings are embedded inclined to the surface of the thermal barrier coating or a metal component to which the thermal barrier coating is attached.

13. A method of monitoring according claim 12, wherein the fiber lead or the fiber Brag gratings are embedded in the thermal barrier coating and a metal component to which the thermal barrier coating is attached.

14. A method of monitoring according claim 1, wherein the monitoring is performed real-time or near real-time.

15. A method of monitoring according claim 1, wherein the fiber Bragg grating sensor is mounted on or within a carrier.

16. A method of monitoring according claim 15, wherein the carrier is a ceramic carrier.

17. An apparatus for monitoring the condition of a metal component, said apparatus comprising:

a fiber lead embedded into the metal component;

at least one fiber Bragg grating sensor embedded into the metal component, such that the fiber Bragg grating is affected by a thermal or mechanical expansion of the metal component; and

a mechanism using the thermal or mechanical expansion of the metal component or the changing of a refraction index of the fiber to determine changes in temperature or strain.

18. An apparatus according claim 17, wherein the thermal barrier coating or the metal component are within a turbine engine.

19. An apparatus according claim 17, further comprising devices for real-time or near real-time measurement.

20. An apparatus according claim 17, further comprising a light source which provides an incident spectrum which covers all wavelengths of the sensors.

21. A metal component within a turbine engine, comprising:

a fiber lead embedded into said metal component;

at least one fiber Bragg grating sensor embedded into said metal component, wherein the fiber Bragg grating is affected by a thermal or mechanical expansion of the metal component;

a light source which provides an incident spectrum which covers all wavelengths of the sensors; and

a mechanism adopted to use the thermal or mechanical expansion of the metal component or the changing of a refraction index of the fiber to determine changes in temperature or strain of the metal component.

22. A metal component according claim 21, wherein the metal component is coated with a ceramic thermal barrier coating.